

The Bullwhip Effect in Supply Chain

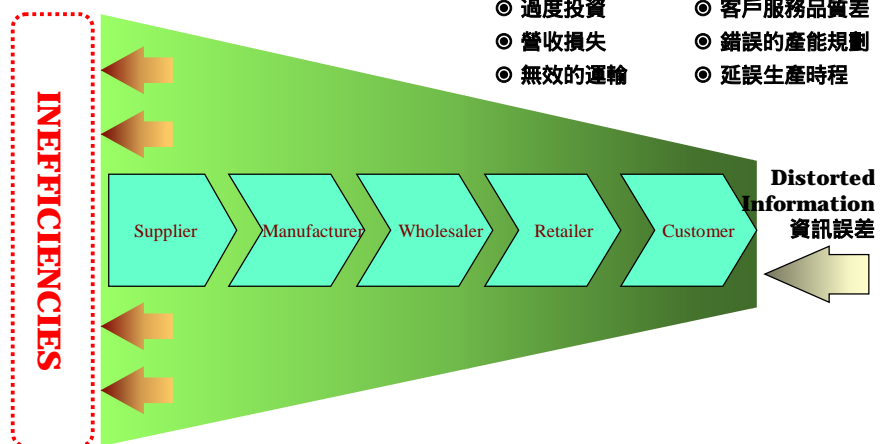
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Bullwhip Effect

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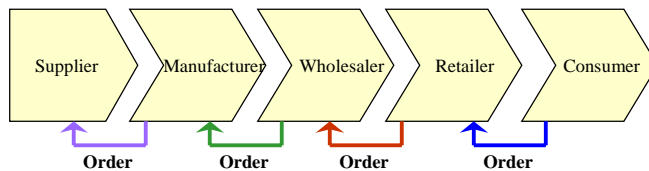
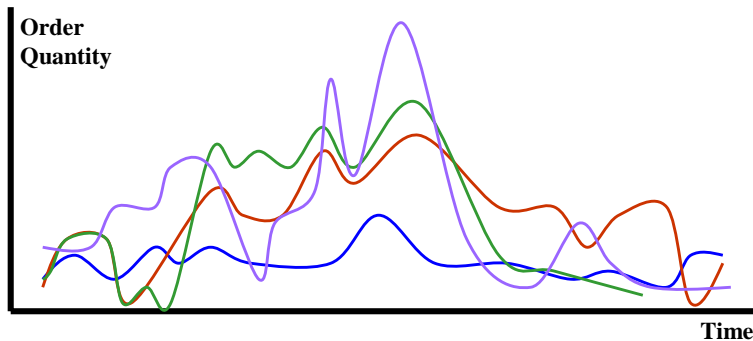
- ◎ 過度投資
- ◎ 營收損失
- ◎ 無效的運輸
- ◎ 客戶服務品質差
- ◎ 錯誤的產能規劃
- ◎ 延誤生產時程



This Paper aims to....

- What is Bullwhip Effect?
- How does it happen?
- How to solve it?

Bullwhip Effect



Bullwhip Effect

- Demand order variability in the supply chain were amplified as they moved up the supply chain.
- Also called “whiplash” or “whipsaw” effect.

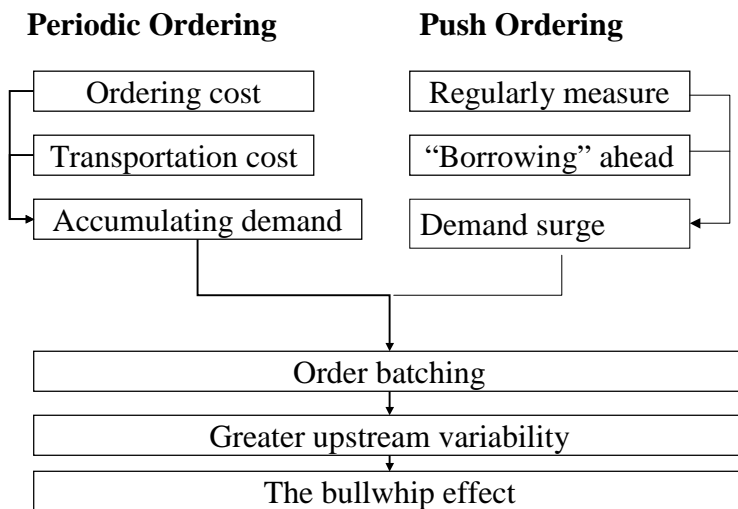
Four Major Causes

- Demand forecast updating
- Order batching
- Price fluctuation
- Rationing and shortage gaming

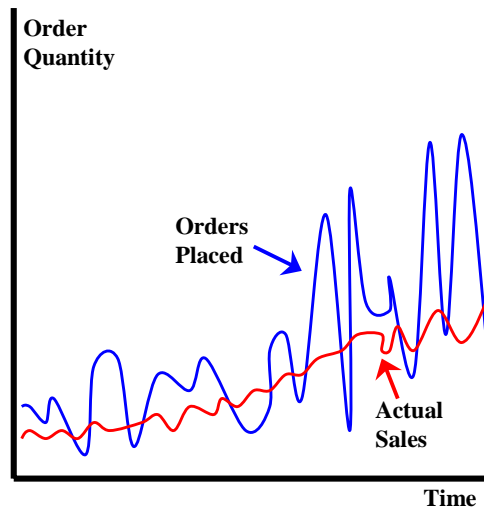
Demand Forecast Updating

- Forecast based on order history of immediate customers.
- Demand signal processing is a major contributor to bullwhip effects.
- As the lead times between the resupply of the items along the supply chain are longer, the fluctuation is more significant.

Order Batching ⇒ Bullwhip effect



Order Batching



Ordering Cost

- Time and cost of processing an order can be substantial
- manual interventions needed in order, billing and shipment systems
- e.g. P&G: \$35~75 per invoice
- MRP System
 - often run monthly, resulting in monthly ordering with suppliers

Transportation Cost

- Obstacle for ordering frequently:
 - the economics of transportation
 - FTL(full truckload) v.s. less-than-truckload rate
 - Suppliers give best pricing for FTL
 - Full or close to FTL ordering⇒excessively long order cycles.

Periodic Ordering

- Ordering cost and transportation cost
- Order variability is higher than the customer demands the company itself faces. Periodic ordering amplifies variability and contributes to the bullwhip effect.
- If all customers' order cycles were spread out evenly throughout the week, the bullwhip effect would be minimal.

Push ordering

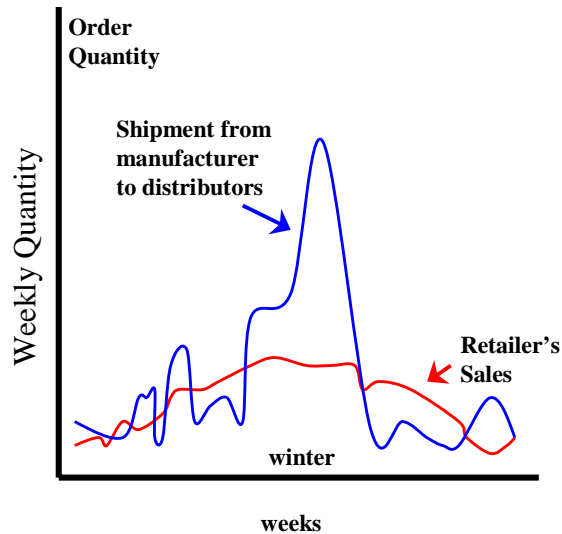
- The company has orders “pushed” on it from customers periodically because:
 - salespeople are regularly measured.
 - Cause end-of-quarter or end-of-year surges
 - Sales quota: Borrow ahead and sign orders prematurely
- The ordering pattern from their customers is more erratic than the consumption patterns that their customers experience.

Price Fluctuation

Forward buying

- Items bought in advance of requirement
- Due to :
 - Consumer promotion
 - Trade deals
- Results:
 - Customer’s buying pattern does not reflect its consumption pattern
 - Variation of buying quantities is much bigger than the variation of the consumption rate

Bullwhip effect due to seasonal sales of soup



Advantage and Disadvantage

- Advantage: low price
- Disadvantage:
 - Huge piles of inventory
 - Pay premium freight rates to transport
 - Damage due to handling larger volumes
 - Stocking inventories for longer periods

Rationing and Shortage Gaming

- Anticipated shortage
 - Placing multiple orders
 - Placing excess orders

Counteracts

- Avoid multiple demand forecast updates
- Break order batches
- Stabilize prices
- Eliminate gaming in shortage situations

Avoid Multiple Demand Forecast Updates

- Make demand data at a downstream site available to the upstream site. (POS)
- Implement EDI for data sharing.
- Upstream site use demand data for forecast updates and resupply for the downstream site.
- Upstream site's direct access to demand data.
- Improve operational efficiency to shorten resupply lead time . (JIT)

Break Order Batches

- Information Sharing
 - EDI or Internet ordering
- Channel Alignment
 - Discount for truckload assortment (e.g. P&G)
 - Delivery appointments(e.g. P&G)
 - Composite distribution (e.g. Tesco and Sainsbury)
 - Third-party logistics (e.g. Tesco and Sainsbury)
- Operational Efficiency
 - Reduction in fixed cost of ordering by EDI or EC
 - CAO (e.g. Nabisco)

Stabilize Prices

- Reduce both the frequency and the level of wholesale price discounting.
- Channel Alignment
 - Continuous replenishment program (CRP) – plus CAO
 - Everyday low cost (EDLC)
- Operational Efficiency
 - Everyday low price (EDLP)
 - Activity-based costing (ABC)

Eliminate Gaming in Shortage Situations

- When shortage occurs, upstream sites allocate products in proportion to past sales records, in stead of orders.
- Sharing of capacity and inventory information.
- Introduction of stringent cancellation policies.

Conclusion

- Bullwhip effects are products of **rational decisions** of supply chain members.
- Bullwhip effects **can** be effectively counteracted.
- The choice: either let the bullwhip effect paralyze the company or find a way to conquer it.